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Analysis of Wage-Gender Discrimination in Connection with Higher Education in the Bahamas

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Abstract

Although about half of the workforce is women, there is no country in the world where a woman earns the same as a man for doing the same job. It is estimated that it takes several decades to close the gender gap. The reported gender gap has been 34% in the US in 2014, that is, female workers made year-round only 66 cents for every dollar earned by men doing the same job.

This paper aims to study whether there is any wage discrimination in The Commonwealth of The Bahamas in regards to gender and its connection to education. We will also investigate whether higher education is associated with a higher wages. In this study, we have collected the data through survey from the Bahamian people working in The Bahamas. Inferential and descriptive statistics are applied to perform the analysis.

Keywords: Wage-gender; Higher education; Bahamas

Introduction

The importance of a good education is always being stressed to young adults. It is a common ideology that a good education can bring equality between gender roles and social classes. In addition, better education can bring forth more money in the sense of getting better paying jobs due to qualification. Cultural norms in most countries have a tendency to favor males in the social hierarchy. This is especially true for developing countries [1]. However, in many countries, there are bills that have been amended to ensure that employees are treated equally for the work they perform. For example, there is the Equal Pay Act and the Civil Rights Act in the United States [2]. Under section 703(a) of the Civil Right Act there are outlines that help prevent discrimination towards employees. It is summarized as it is unlawful employment practice for an employer to:

a. Fail or refuse to hire or to discharge any individual, or otherwise to discriminate… based on an individual's race, color, religion, sex, or national origin.

b. Limit, segregate, or classify employees in a way which would deprive… employment status, because of such individual's race, color, religion, sex, or national origin.

For more detail, see Appendix.

Similarly, the Equal pay act prohibits employers from discrimination on the basis of sex as follows, "No employer having employees subject to any provision of this section shall discriminate… on the basis of sex by paying wages to employees in such establishment at a rate less than a rate at which he pays wages to employees of the opposite sex". Even though these measures have been constructed, wage discrimination has still been observed. This can be witnessed among women and men [3] and in some cases across races [4]. O'Neill and O'Neill reported in their study that White employees earned the highest wage. Among the minority classes, African American employees were better compensated than Hispanics and Asian employees are paid as much as (or occasionally even more than) the White employees [4]. Furthermore, it seems education, sex, and race has a significant influence on earnings [5]. In addition, based on research by the United States Government Accountability Office [6] in 2011, although the wage gap among men and women with the same work position has been narrowed, females still make less than the males doing the same job.

Similarly, The Commonwealth of The Bahamas has an Employment Act which provides guidelines to prevent employer discrimination (Bahamas: Employment Act). Under section (6) of the Act it reveals that, an employer should not discriminate employment on the basis of race, creed, sex, marital status, political opinion, age or HIV/Aids. Also, employees working the same job and having the same skills should be paid the same wage. The difference in wage should not be based on marital status, age, and race unless there is some seniority or merit [7]. The goal is to determine if gender affects wage in The Bahamas.

The Commonwealth of The Bahamas is a developing country, which depends majorly on imports for its economical sustainability. This country is a major vacation destination in close proximity of North America with tourism and tourism-driven industries that employ almost half of the labor force and making about 60% of GDP. Due to the dependence of the tourism industry, the country's economy is directly influenced by what happens in the US economy.

We use data analysis methods to study wage-gender discrimination. Some of the analyses are to the analysis conducted by Bradburn and Zimbler [8]. They utilized a regression analysis to study wage discrimination and concluded that full-time female faculty members earned nearly nine (9) percent less than what their male counterparts did. Furthermore, they showed that Asian/Pacific Islander faculty salaries were higher than White faculty salaries and the White faculty salaries were higher than Black faculty salaries. This result agrees with previous work done by O'Neill and O'Neill.

Here in this research, the aim is to determine if there is discrimination in wages possibly due to gender. This study is conducted as there has not been much work performed to study the education and gender

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factors for the wage analysis and reflect the statistical significance of these factors in The Bahamas' work force.

Data Section

The data for this study was collected using an online survey application based on Google Docs. Through online forum, emails, social media, etc., the survey was posted and sent to Bahamians for participation. Participants that responded were encouraged to share the survey with their family, coworkers, and friends in an attempt to reach more people. The survey was posted from July 8, 2014 until August 24, 2014, and consisted of eight (8) questions. Among the total number of 282 who responded 93 were males and 189 were females. This sample is used to study working population of The Bahamas. Respondents were asked to answer questions based on education, age, gender, and wage as depicted in Table 1. If someone failed to answer any of those questions, their survey was disregarded.

Method

To determine if there is disparity in wage in The Bahamas, we extracted the independent variables including Education and Gender from the survey. Gender is a nominal variable with two levels female and male. Education is considered an ordinal variable assuming equal distances between different educational levels where different levels of education are high school without diploma, high school diploma, vocational training, associate's degree, bachelor's degree, master, and other. Several statistical analysis methods including regression, one-way and two-way Analysis of Variance (ANOVA) with and without interaction, contingency tables, box plots, and heat maps are applied to study the wage-gender discrimination.

Anatolyev and Kosenok used contingency tables in order to test homogeneity of each given variable [9]. We used contingency tables to test the homogeneity for education and gender against wage.

Linear Regression allows the study of simultaneous effects of multiple independent variables to be accounted [10]. Corcoran used gender and education in a linear model to study wage [11]. There are also several models used by Wooldridge to study disparity in wage [12]. We will use similar models to perform regression analysis to investigate wage disparity in The Bahamas. The models vary from simple to multivariate regression as follows:

Models (1) and (2) show simple linear regression with single independent variable. Model (3) is a multiple regression with gender and education as independent variables.

$$Wage=\beta_0+\beta_1*education+\epsilon \quad (1)$$

$$Wage=\beta_0+\beta_1*gender+\epsilon \quad (2)$$

$$Wage=\beta_0+\beta_1*education+\beta 2*gender+\epsilon \quad (3)$$

Where Gender is a nominal (categorical) variable with zero (0) for male and (one) 1 for female, and education is an ordinal variable with equal distances between different education levels.

In the models, ϵ is the error, β_0 is the wage intercept, β_1 represents the difference in wage for each unit difference in education if gender remains constant. As education is an ordinal variable with values from one to eight, a one-unit increase represents moving from one education level to the next. Similarly, β_2 represents the difference in wage for each unit difference in gender if education remains constant. As gender is a categorical variable with values of zero and one, a one-unit difference represents switching from one gender to another.

In addition to linear regression, we used analysis of variance (ANOVA). Two factors including Education, and Gender are considered. ANOVA can be applied to test whether there is significant difference between the means for different levels of a factor [13]. ANOVA is implemented by testing the following hypothesis:

$$H_0: \alpha_0=\alpha_1=\cdots=\alpha_k \quad (4)$$

Against the alternative hypothesis Ha, that is, at least two groups (levels) have different means. ANOVA is performed to test whether there is a significant difference in the wage based on different levels of education and/or gender.

Results and Discussion

In this section, we apply the methods that were explained in the previous section to the collected data and discuss the results. The main interest here is to study wage gender discrimination.

Contingency tables and homogeneity test

There were a total of 282 respondents to the survey, 93 were male and 189 were female. The wage vs. gender and wage vs. education are demonstrated in Tables 2 and 3 respectively. Table 2 shows the number of respondents based on gender and the annual wage range. For example, we can observe that there were a total of 74 respondents included 28 males and 46 females within $20,000 to $29,999 annual wage range.

Table 3 displays wage vs. education level where abbreviations are as follow: HSND for High School No Diploma, HSWD for High School with Diploma, CCND for College Credit No Degree, VT for Vocational Training, AD for Associates Degree, BD for Bachelor's Degree, and MS for Master's Degree. As we can see in Table 3 the

Variables	Values							
Level of Education	High School No Diploma	High School With Diploma	College Credit No Degree	Trade/Vocational Training	Associate	Bachelor	Masters	Other
Sector of Employment	Tourism		Private		Public		Financial	
Marital Status	Single	Married		Divorce	Widowed		Separated	
Ethnicity	Asian/pacific Islander	Black/African American		Caucasian/White	Hispanic/Latino	Multiracial	Indigenous	No Response
Sex	Male				Female			
Age	<16	16-20	21-30	31-40	41-50	51-60	>60	
Income (Yearly)	<10k	10k-19,999	20k-29,999	30k-39,999	40k-49,999	50k-74,999	>75k	
Employment Status	Full Time				Part Time			

Table 1: Questionnaire for survey.

	Gender		
Wage	**Male**	**Female**	**Total**
<10K	16	55	71
10K-19,999	28	46	74
20K-29,999	28	46	74
30K-39,999	11	18	29
40K-49,999	6	9	15
50K-74,999	3	12	15
>75K	1	3	4
Total	93	189	282

Table 2: Frequency of respondents according to wage and gender.

Wage/Education	HSND	HSWD	CCND	VT	AD.	BD.	MS	Other	Total
<10K	4	22	21	1	4	18	1	0	71
10K-19,999	2	25	20	6	8	13	0	0	74
20K-29,999	1	13	6	7	5	42	0	0	74
30K-39,999	0	1	2	1	4	19	2	0	29
40K-49,999	0	0	1	0	0	11	3	0	15
50K-74,999	0	1	1	0	0	3	9	1	15
>75K	0	0	0	0	1	2	0	1	4
Total	7	62	51	15	22	108	15	2	282

Table 3: Frequency of respondents based on wage and education.

Wage/Education	HSND	HSWD	CCND	VT	AD.	BD.	MS	Other	Total
<10K	3	16	16	1	2	16	1	0	55
10K-19,999	0	17	15	1	5	8	0	0	46
20K-29,999	0	4	5	1	3	33	0	0	46
30K-39,999	0	1	2	0	4	10	1	0	18
40K-49,999	0	0	1	0	0	6	2	0	9
50K-74,999	0	0	1	0	0	2	9	0	12
>75K	0	0	0	0	1	2	0	0	3
Total	3	38	40	3	15	77	13	0	189

Table 4: Female distribution for wage vs. education.

Wage/Education	HSND	HSWD	CCND	VT	AD.	BD.	MS	Other	Total
<10K	1	6	5	0	2	2	0	0	16
10K-19,999	2	8	5	5	3	5	0	0	28
20K-29,999	1	9	1	6	2	9	0	0	28
30K-39,999	0	0	0	1	0	9	1	0	11
40K-49,999	0	0	0	0	0	5	1	0	6
50K-74,999	0	1	0	0	0	1	0	1	3
>75K	0	0	0	0	0	0	0	1	1
Total	4	24	11	12	7	31	2	2	93

Table 5: Male distribution for wage vs. education.

majority of participants have a BD which is followed by people having a high school diploma (HSWD). The most frequent wages among respondents are $10,000-$19,999 and $20,000- $29,999. There are the same number of respondents with VT and MS (15 for each). There are also seven respondents without a high school diploma (HNSD) and two participants with higher level qualifications including PhD and Professional degrees (Other category).

Tables 4 and 5 provide the same information as Table 3 for female and male respectively. As it can be observed there are more male than female respondents without high school diplomas, vocational training, and 'Other' qualifications, and there are more females making over $75,000 than males.

We tested the homogeneity for education and gender against wage, and the results are shown in Table 6. The p-values of the Bartlett Test were computed to test the homogeneity of the variances for the independent variables. The p-value for education is 0.00860, which is strong enough to reject the null hypothesis and conclude that the variance across education groups is not the same. However, the p-value for the gender variable is 0.1109, which does not demonstrate evidence through the observed sample to reject the null hypothesis. Hence, we can conclude that the wage is homogeneous between two gender groups [14-18].

Linear regression

In the next step, we applied linear regression models that are described in the method section for further analysis. Table 7 displays a summary of the regression coefficients for each model. The regression

	DF	K-Squared	P-Value
Education	7	18.8705	8.60E-03
Gender	1	2.5419	0.1109

Table 6: Result for homogeneity.

Coefficients	Model 1	Model 2	Model 3
β_0	906.85	2741.9	1052.2
β_1	404.14	-122.9	409.2
β_2			-249.8
p-value	<2.2e-16	0.5123	<2.2e-16
F-statistic	94.96	0.4304	48.9
Multiple R-squared	0.2533	0.001535	0.2596
Adjusted R-squared	0.2506	-0.0023031	0.2543

Table 7: Coefficients for linear regression models.

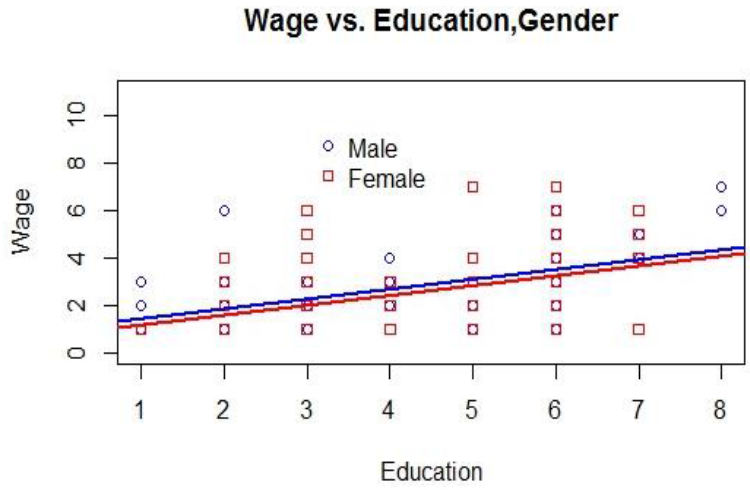

Figure 1: Male (blue) and female (red) regression lines.

analysis for Model (1) shows that regardless of gender factor and for the education factor equal to zero, the average wage β_0 would be about $906.85 annually. We can also observe that the annual average wage will increase by about $404 from one education level to the next one. In regards to gender being the only predictor and regardless of education factor, females make about $123 less than males on average annually according to the Model (2). Finally, Model (3) demonstrates that with gender and education factors set to zero, the average annual wage β_0 is about $1052.2. Based on the estimated parameters of the regression model, the Model (3) is:

$$wage = 1052.2 + 409.2 * education - 249.8 * gender$$

The model shows that the education factor positively affects wage, as the level of education increases the mean wage increases by a factor of $409.20 where the gender factor is equal to zero (male). However, having β_2 equal to -249.8 shows that at the same education level females ($gender$=1) make $249.8 less than males. To better observe this wage disparity, we divided the model into two models based on the value of the gender factor; i.e. zero for males and one for females as follows:

$$wage = 1052.2 + 409.2 * education \text{ (Male)}$$

$$wage = 802.4 + 409.2 * education \text{ (Female)}$$

These models are illustrated in Figure 1. The blue line (male) shows a constant wage increase across all education levels. This is also true for the female participants (red line). As we can observe, higher levels of the education (regardless of gender) are associated with higher wages. However, the blue regression line is higher than the red one, which shows that the male wages are slightly higher than female wages across all education levels.

Analysis of variance (ANOVA)

For further analysis, we apply ANOVA in the next step. We first use one-way ANOVA for education and gender separately. Depicted in Table 8, it can be seen that education with a p-value of less than 0.0001 has a significant effect on wage in The Bahamas (F=30.441, p<0.0001). However,, the gender variable with a p-value of 0.512 (F=0.43, p=0.512) suggest that there is not enough evidence solely based on gender to conclude that gender has a significant effect on wage in The Bahamas. In the first look it seems that this conclusion is inconsistent with what we inferred earlier using regression, i.e. gender does affect wage.

To justify what was inferred using regression analysis (gender affect wage) we need to determine whether education and gender interact. Therefore, to get a better insight about gender and education factors, a two-way ANOVA with interaction was performed as follows:

$$Wage = \beta_0 + \beta_1 * education + \beta_2 * gender + \beta_3 * education * gender + \epsilon \quad (6)$$

The results are displayed in Table 9. As we can see the education

	DF	Sum of Squares	Mean Squares	F-Value	p-value
Education	7	213.1	30.441	20.84	<2E-16
Gender	1	0.9	0.9413	0.43	0.512

Table 8: One way ANOVA.

	DF	Sum Square	Mean Square	F Value	P-Value
Education	7	213.09	30.4414	21.3004	<2.00E-16
Gender	1	2.97	2.9687	2.0772	0.15068
Gender*Education	6	15.68	2.6132	1.8285	0.09373
Residual	267	381.58	1.4291		

Table 9: Two way ANOVA with interaction.

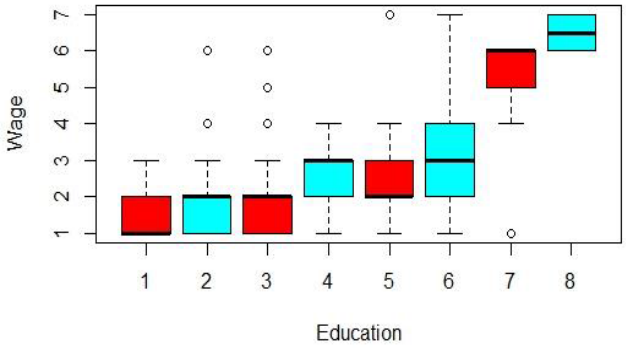

Figure 2: Boxplot of wage vs. education.

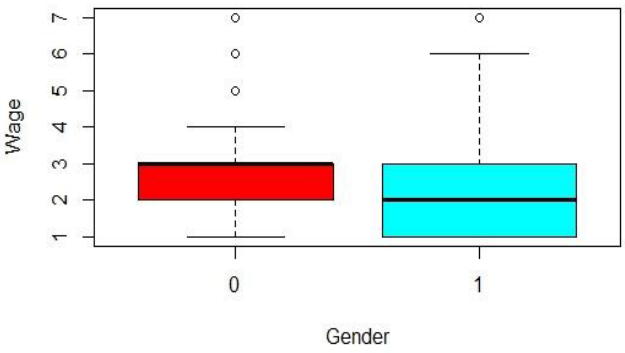

Figure 3: Male (red) and female (blue) wage boxplots.

factor (F=21.3004, p<0.0001) has a significant effect on wage similar to what was concluded using one-way ANOVA. However, it shows that gender factor has much smaller p-value (p=0.15) in comparison with the one-way analysis (p=0.51). Moreover, considering the fact that the sample size for male (93) and female (189) are not that large, the modest p-value of 0.09 demonstrates some interaction between gender and education. This shows that although gender alone could not well explain the wage variations, education and gender together can explain most of the variance in the data. This demonstrates consistent wage discrimination based on gender for different levels of education.

Boxplots

Boxplot depicted in Figure 2 shows the distribution of Wage based on Education. It displays the minimum, first quartile, median, third quartile, maximum, and outliers for Wage regarding Education level. The numbers on the education axis correspond to those in Tables 2 and 3 (i.e. HSND=1; HSWD=2; etc.). Similarly, the numbers on the Wage axis correspond to Tables 2 and 3 (i.e. 1: Making less than $10K; 2: Making between $10K and $19,999; etc.). For example, we can see that regardless of gender, the minimum wage for a person with a bachelor's degree ('6' on the education axis) is below $10K, the median is $31K, and the maximum is over $75K.

Figure 3 displays the distribution of Wage based on Gender and gives insight about the minimum, first quartile, median, third quartile, maximum, and outliers for Wage regarding Gender. Zero is associated with male and one with female on the Gender axis. Similarly, the numbers are assigned on the Wage axis in accordance with Tables 2 and 3 (i.e. 1: Making less than $10K; 2: Making between $10K and $19,999; etc.). For example, regardless of education level, the minimum wage for a male person is below $10K, the median is about $28K, and it is as high as $75K, which is identified as an outlier in the plot.

The distribution of Wage based on Education for male and female

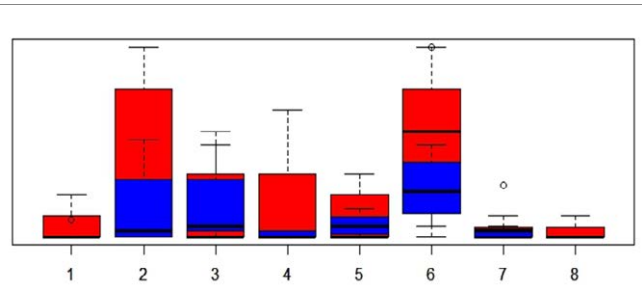

Figure 4: Overlaying boxplot of male (red) female (blue) wages across education levels.

are superimposed in Figure 4. This Figure magnifies how wage differs across education levels for male (red) and female (blue). There is a clear indication of wage discrimination in the Bahamas, according to the sample data. There are some cases where the median salary of the blue plot is more than that of red plot. However, across every factor for education the maximum wage of red is greater than that of blue. This agrees with wage discrimination in the work place for similar qualification.

Heat maps

Heat maps are used to visualize at least two variables. The aim is to visualize Gender based on both Education and Wage. In Figures 5 and 6 we plot the count for each gender based on the variable education and wage respectively. Whereas, the percentages for each gender based on the education are displayed in Figures 7 and 8. Since there are 93 male and 189 female respondents, the percentages will give a better indication of the proportion for male and female.

In Figure 5, we see that there were more male than female who did not complete high school and rather completed a vocational training.

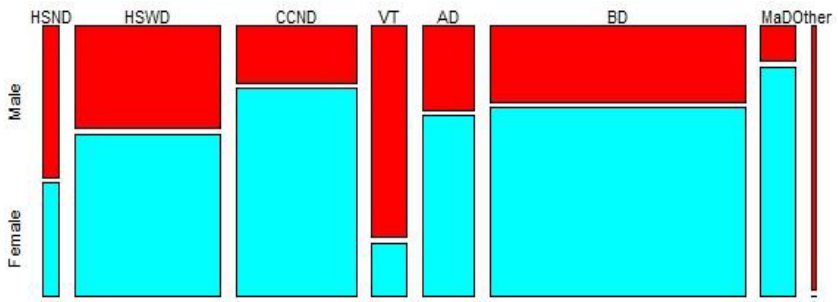

Figure 5: Heat map of gender according to education, male (red) and female (blue).

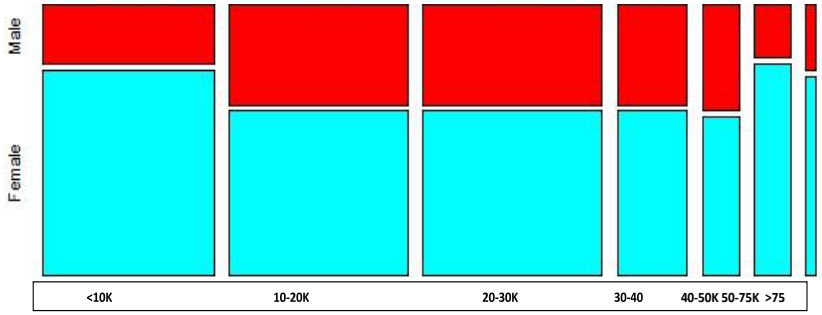

Figure 6: Heat map for gender according to wage, male (red) and female (blue).

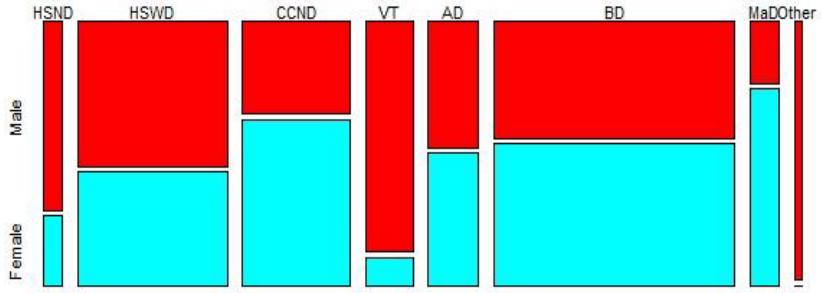

Figure 7: Heat map for gender according to wage, male (red) and female (blue).

There were only male respondents in the 'other' education. The width of each level is proportional to the number of respondents (both males and females) for the given education level. For example, the majority of respondents (regardless of gender) have a Bachelor's degree, which is followed by High school Diploma, while the least number of respondents have "other" education factor.

In Figure 6, the annual wage is distributed according to the gender. The majority of respondents have wages below $30K which are almost evenly distributed in three bins including less than $10K, $10K-$20K and $20K-$30K. Despite having less number of male respondents than females, males are represented in all wage categories. The females however, are dominated across all wage ranges based on the number of respondents in each wage range.

The proportion of males and females according to education are displayed in Figure 7. It provides a better intuition about the distribution of wage based on education and gender. This is important as the number of female respondents is almost twice as many as the male ones. As we can observe in Figure 7, in contrast with Figure 5, the proportion of males at HSWD category is more than the proportion of females in this category. Moreover, the proportion of males in AD education level is almost the same as proportion of females in this education level. Based on the figure, the highest proportion of respondents has a Bachelor's Degree, while the proportion of males with BD is almost the same as the proportion of females with BD.

The wage distribution based on gender is shown in Figure 8 where the proportion of respondents (for each gender separately) is used in place of the number of them. As we can observe, still a higher proportion of respondents have wages below 30K. However, in contrast with Figure 6, the proportion of females who make less than $10K or more than $50K is greater than the proportion of males at these wage levels and the proportion of males who make between $10K and $50K is higher than that of females.

Conclusion

In this study, we investigated the wage discrimination based on education and gender in The Commonwealth of The Bahamas. The data was collected through a total number of 282 surveys including 93 males and 189 females. Participants answer d questions based on education, age, gender, and wage. Eight education levels were

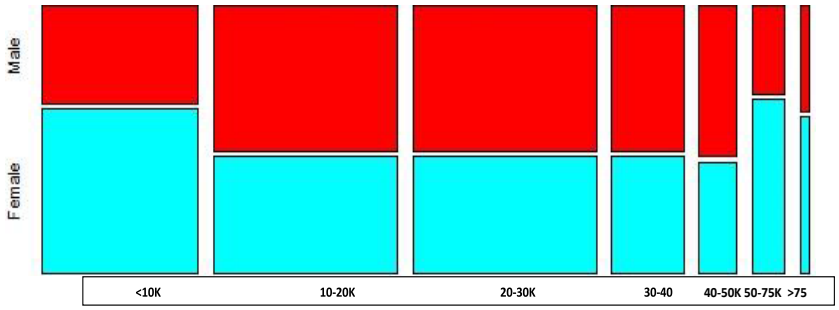

Figure 8: Heat map for gender according to wage, male (red) and female (blue).

considered including High School without Diploma, High School with Diploma, College Credit No Degree, Vocational Training, Associates Degree, Bachelor's Degree, Master's Degree, and other (any degree higher than Master's Degree).

We showed that the variance is not homogeneous across education groups. However, it was homogeneous among the gender groups. Through the regression analysis, we observed that regardless of education factor by considering gender as the only predictor, females make about $123 less than males on average annually and the male wages were higher than females across all education levels. Moreover, we observed that the education is an important factor in determining wage, and it positively affects wage. It means that higher levels of education are associated with higher wages such that the wage increases by amount of $409 in average from one educational level to the next (assuming constant intervals). We validated the results using ANOVA and confirmed that the education has a significant effect on wage in The Bahamas ($F=30.441$, $p<0.0001$). However, there was not strong evidence using one-way ANOVA to conclude that the gender has a significant effect on wage ($F=0.43$, $p=0.512$). Nevertheless, after performing two-way ANOVA with interaction, it was revealed that there is interaction between gender and education. It means, although the gender variable does not well demonstrate the wage variations for different gender levels, education and gender together can explain most of the variation in the wage for different genders and through different education levels. The observations demonstrate consistent lower wages for women in comparison with men at the same education level. By superimposing the wage boxplots based on education levels for male and female participants, we observed that across every level of education, the maximum wage for males is higher than that of females, which suggests potential gender wage discrimination in the work place for similar qualification based on the sample data.

Since the number of female respondents was much more than the male ones, we used the proportion of males and females to study the distribution of wage based on education for different genders. It was observed that the proportion of males without High School Diploma was more than the proportion of females in this category, while the proportion of males with Associate Degree is almost the same as proportion of females in this education level. Moreover, the highest proportion of respondents have Bachelor's Degree, while the proportion of males with BD is almost the same as the proportion of females with BD. Regardless of gender, the proportion of respondents who make below 30K is much greater than those who make more than 30K. However, the proportion of females who make less than $10K, or make more than $50K is greater than the proportion of males at these wage levels. Moreover, the proportion of males who make between $10K and $50K is higher than proportion of females. In the future work we would like to investigate whether the wage disparity has improved over the past decade.

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